

# Direct Measurement of Nanoscale Orientational Order

**Beamline:** X19A

**Technique:** Low-Energy (1.5-4 keV) Resonant X-ray Diffraction Si, Cl, P, Ca, and S k-edges are within this energy range

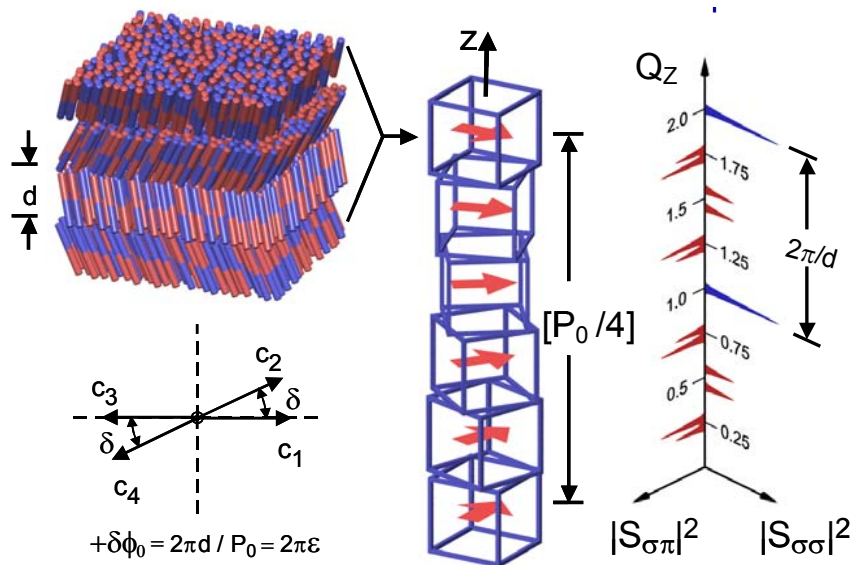
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**Publication:**

A. Cady *et al.*, "Orientational ordering in the chiral smectic- $C_{F12}$  liquid crystal phase determined by resonant polarized x-ray diffraction, *Phys. Rev. E - R. C.* **64** 050702 (2001).

**Motivation:** Inter-layer and intra-layer nanoscale orientational ordering occur in a wide range of different liquid crystal systems. Resonant x-ray scattering provides a *direct* probe of this nanoscale orientational ordering.



The measured structure of the smectic- $C_{F12}$  phase consists of a 4-layer unit cell with  $C_i$  being the in-plane tilt direction of the  $i$ th layer (left), this 4-layer unit cell rotates with a pitch,  $P_0$ , of  $0.3 \mu\text{m}$  (middle), the distinctive resonant diffraction features (right).

**Results:** The interlayer order in a tilted, layered, liquid-crystal phase with a 4-layer periodicity was directly determined in a sulfur-containing compound by measuring the s and p-polarized diffraction features for a s-polarized incident x-ray beam with an energy at the sulfur k-edge. A biaxially distorted helical structure was determined consistent with optical measurements.